BROOKHAVEN NATIONAL LABORATORY

U.S. DEPARTMENT OF ENERGY

Silicon Strip Tracker Production and Assembly

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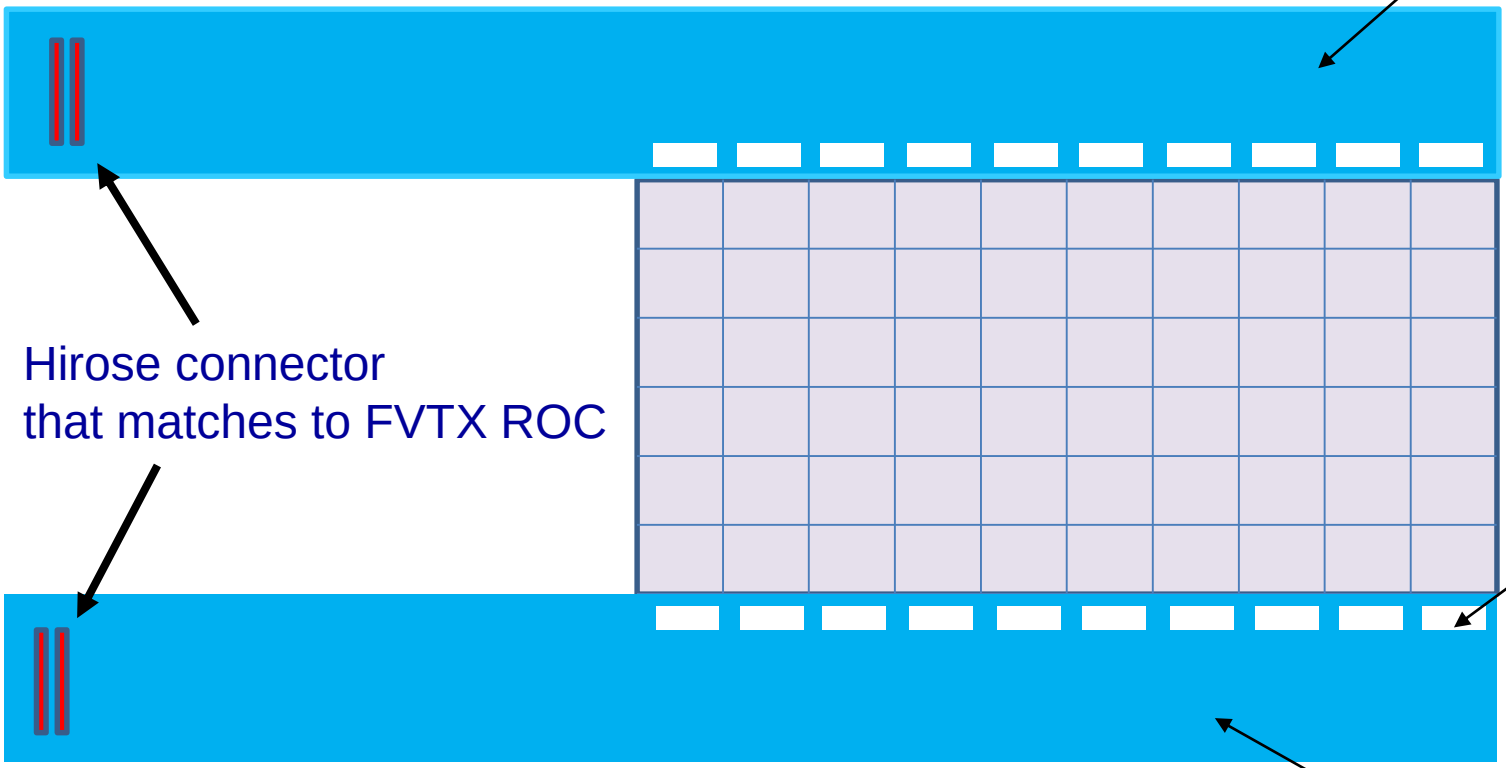
1. Concepts of Si Strip Module, Ladder and Barrel
2. Production Capability and Assembly Facilities
3. Manpower Expertise and Availability
4. Summary

Concepts of Si Strip Module, Ladder and Barrel

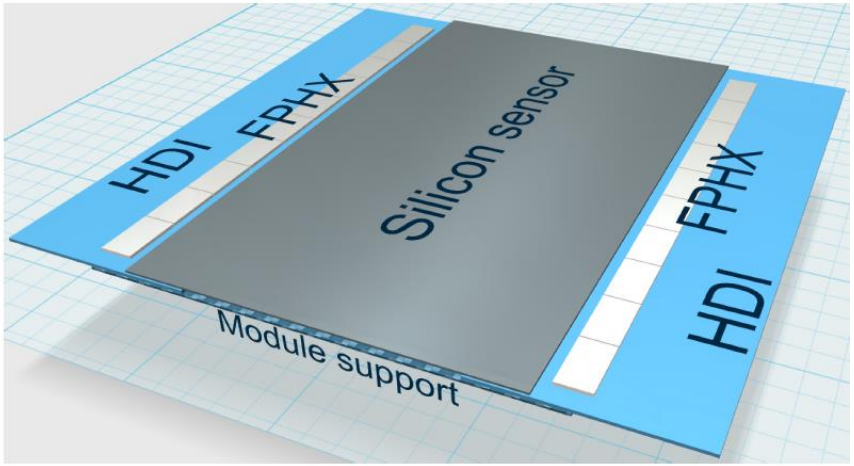
Concepts of Si Strip Module



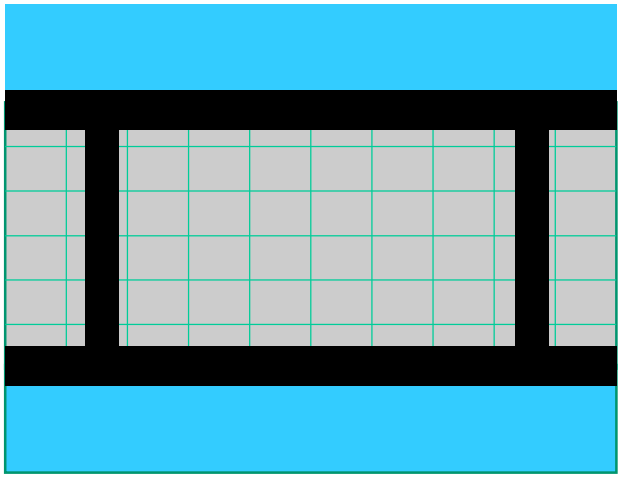
- HDI width: 20 mm
- HDI length: 40 cm including the bus part
- Radiation length: 0.28% (physical thickness 0.45mm)
- Electrically the same as the small Wedge HDI of FVTX. This allows read-out via FVTX ROC+FEM

Concepts of Si Strip Module

Top view



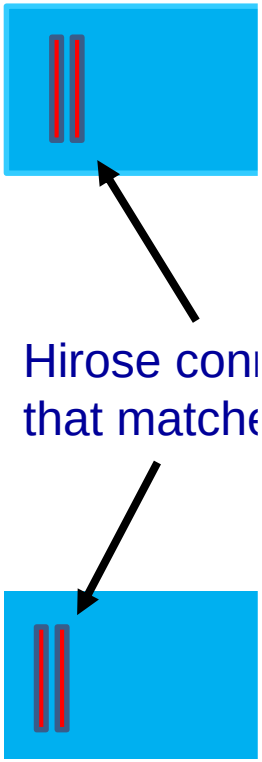
Bottom view



Sensor Module = sensor + HDI/FPHX
+ CFC frame

Concepts of Si Strip Module, Ladder and Barrel

Readout concept of Si Strip is similar to FTX Detector



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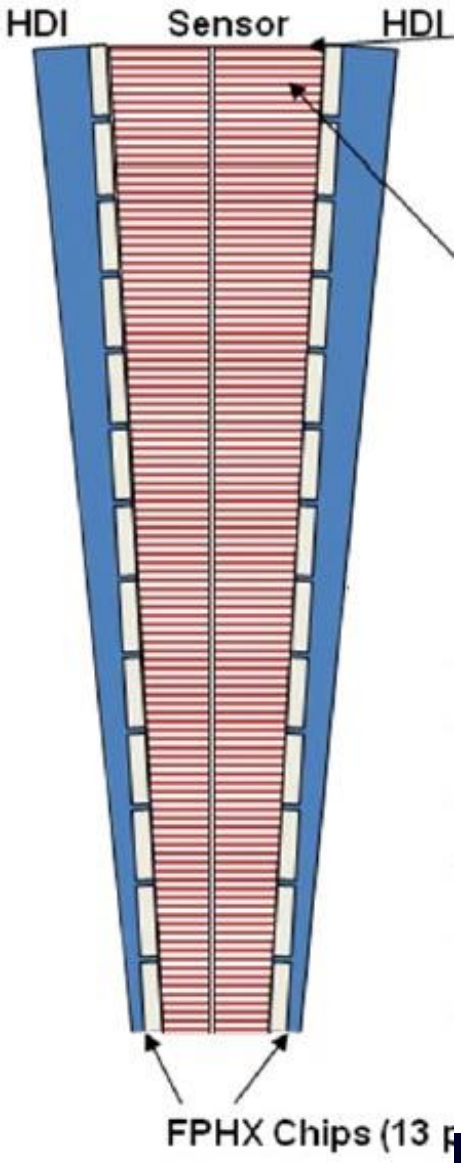
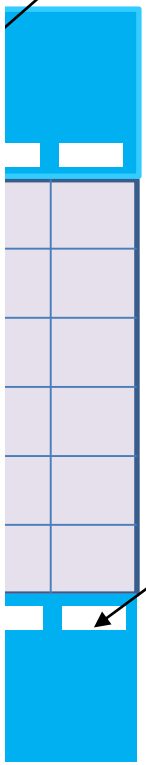




HDI (similar to FVTX detector HDI)

Sensor (conservative design)

FPHX chip (similar to FVTX detector HDI)

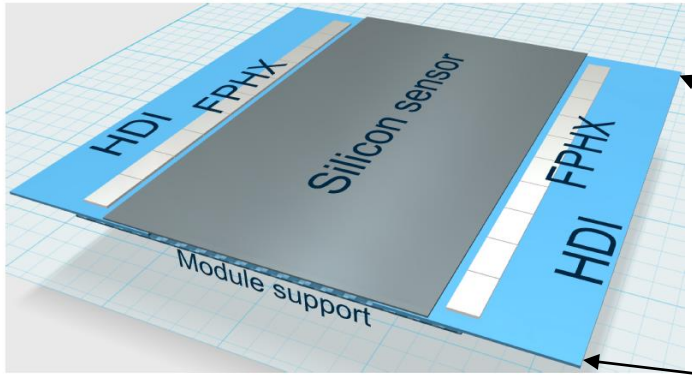
HDI (similar to FVTX detector HDI)

- HDI width
- HDI lengt
- Radiation
- Electricall
  ROC+FEI

ead-out via FVTX

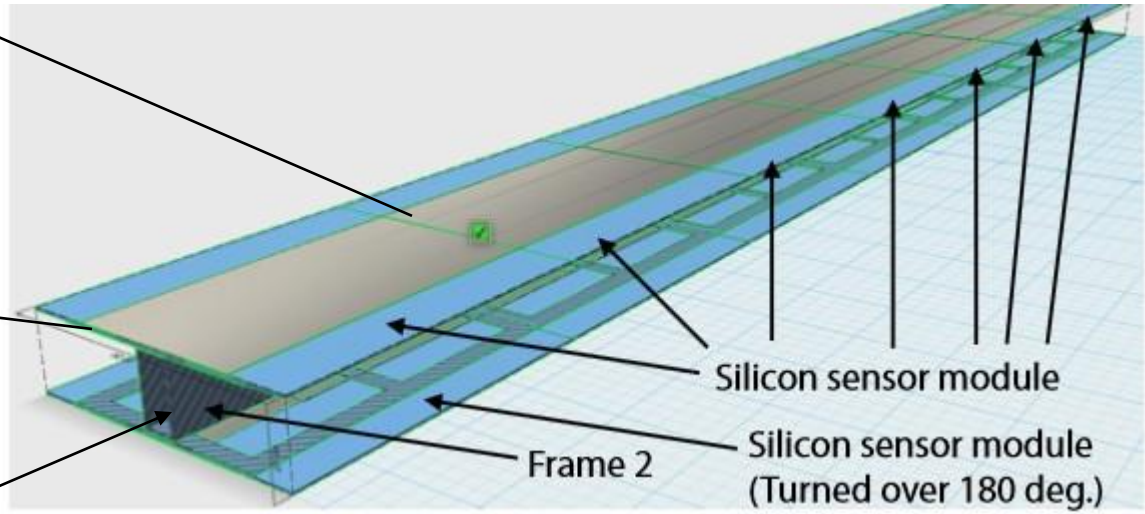
Concepts of Si Strip Module, Ladder and Barrel

Concepts of Si Strip Ladder



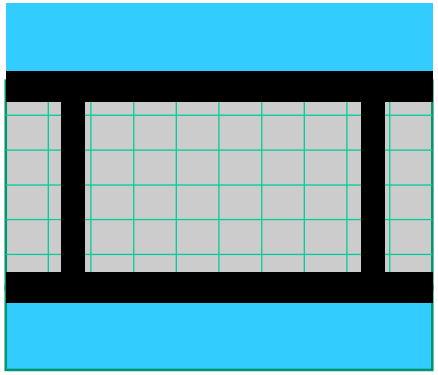
Top view

Side View



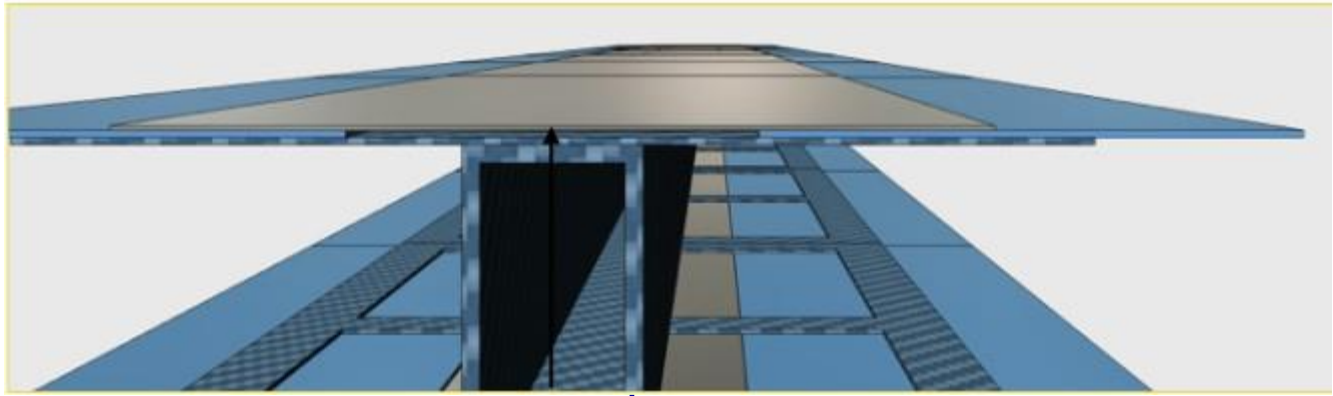
Silicon Module

Bottom view



Air cooling

Sensor Module
= sensor + HDI/FPHX
+ CFC frame



Front View

Concepts of Si Strip Barrels

Table 4.2: Summary of geometries for the silicon strip tracker and the inner tracker made of reused pixels from PHENIX.

Station	Layer	radius (cm)	pitch (μm)	sensor length (cm)	depth (μm)	total thickness X_0%	area (m^2)
Pixel	1	2.4	50	0.425	200	1.3	0.034
Pixel	2	4.4	50	0.425	200	1.3	0.059
S0a	3	7.5	58	9.6	240	1.0	0.18
S0b	4	8.5	58	9.6	240	1.0	0.18
S1a	5	31.0	58	9.6	240	0.6	1.4
S1b	6	34.0	58	9.6	240	0.6	1.4
S2	7	64.0	60	9.6	320	1.0	6.5

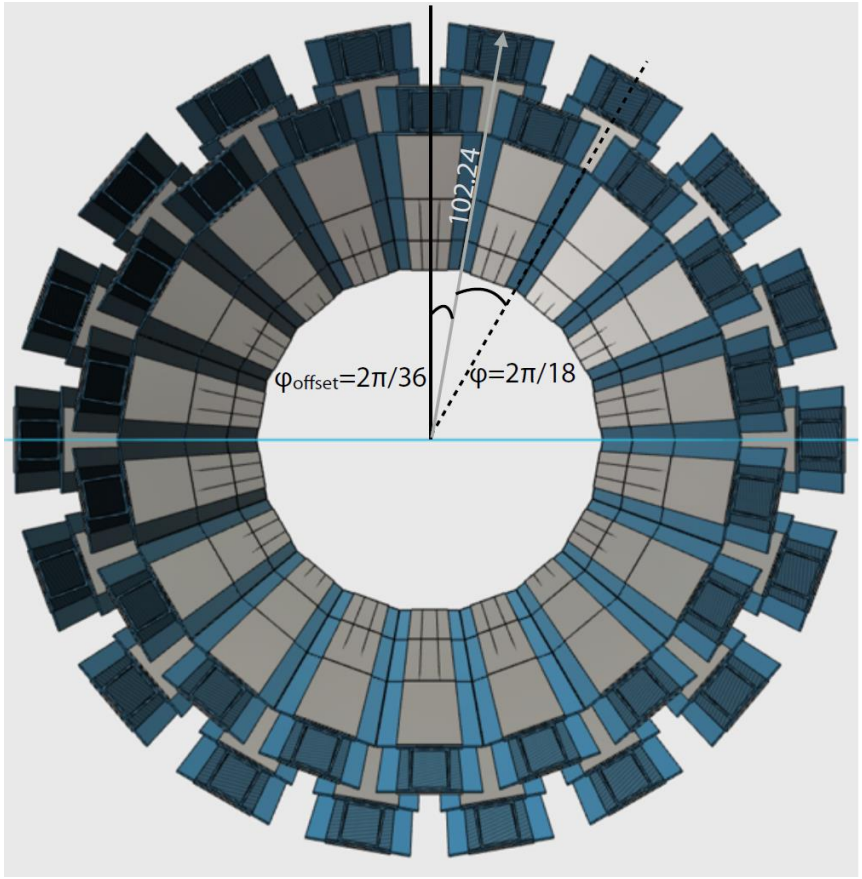
Table 4.3: Number of channel summary for the silicon strip tracker.

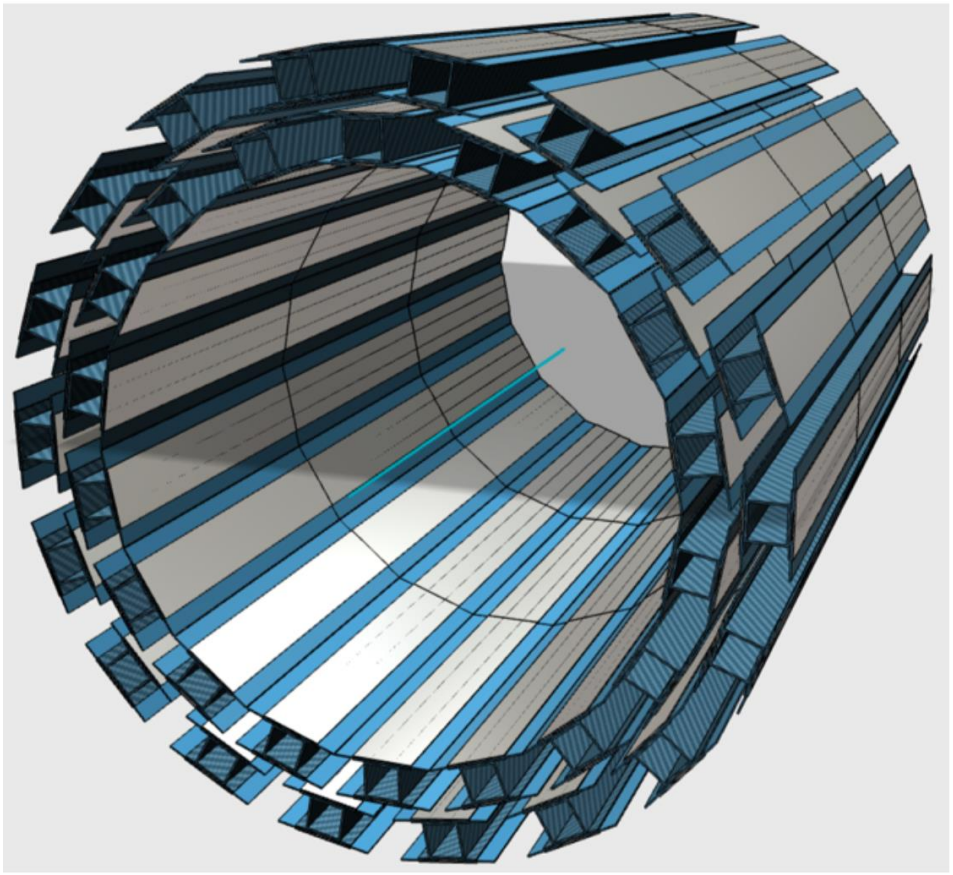
station	sub-layer	silicon modules per ladder	# of ladders	# of sensors
s0	2	3	36	216
s1	2	7	44	616
s2	1	14	48	672

Concepts of Si Strip Module, Ladder and Barrel

Concepts of Si Strip Barrels

S0 barrel (R ~ 8 cm)

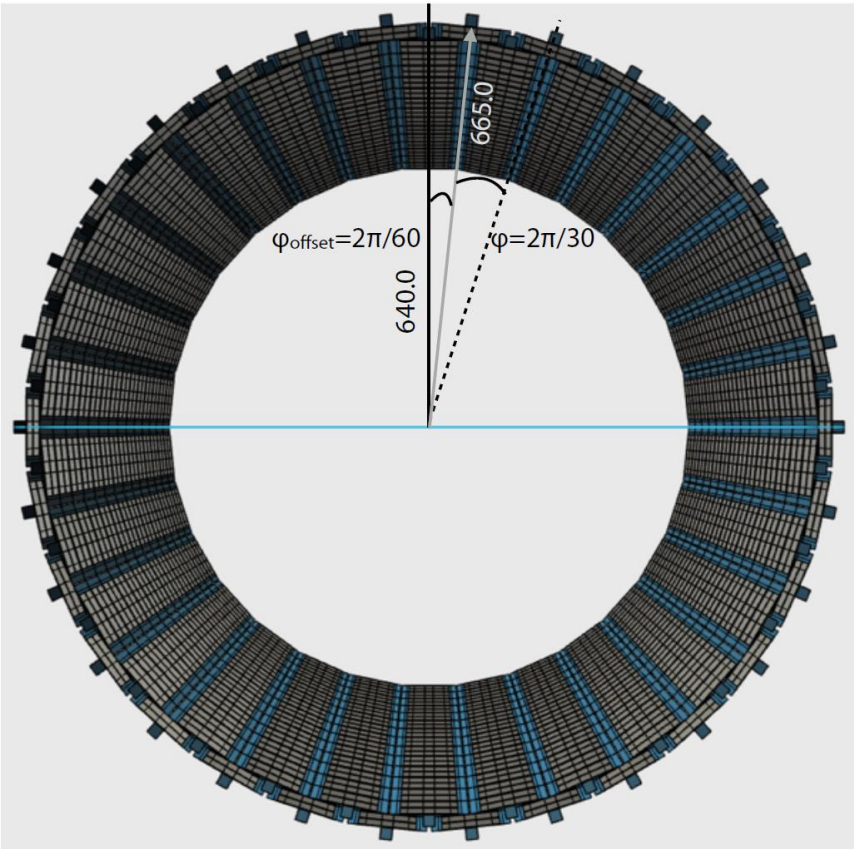


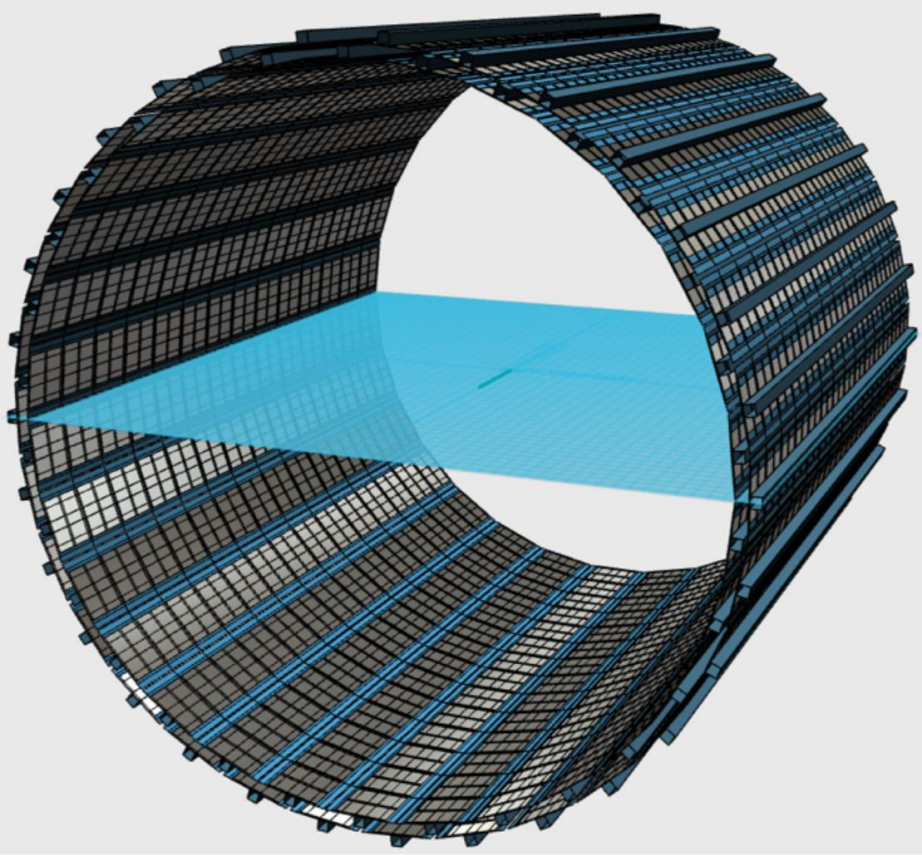


Concepts of Si Strip Module, Ladder and Barrel

Concepts of Si Strip Barrels

S0 barrel (R = 65 cm)





Production Capability and Assembly Facilities

Electronics Support Lab.

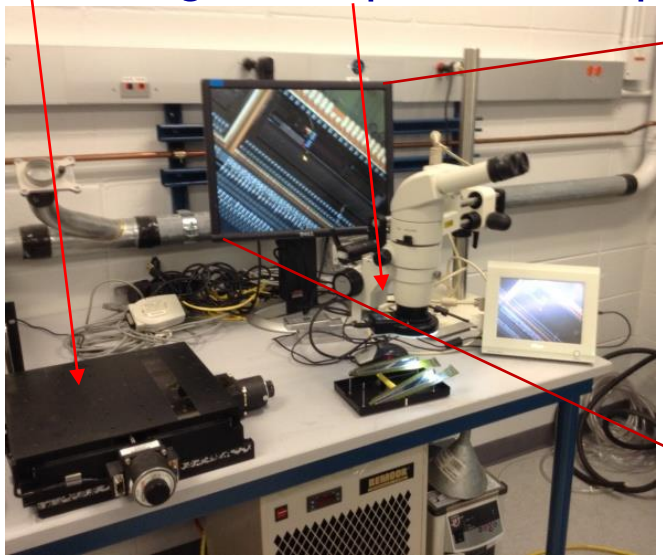
Machine Shop

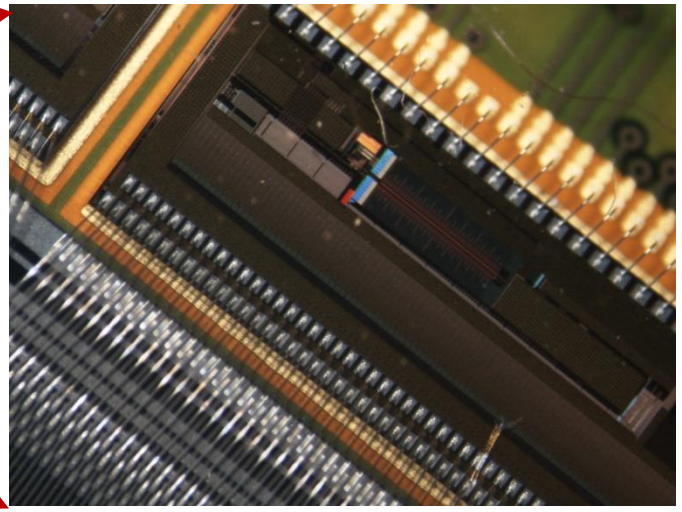
Detector support lab

Main Silicon Lab

Production Capability and Assembly Facilities

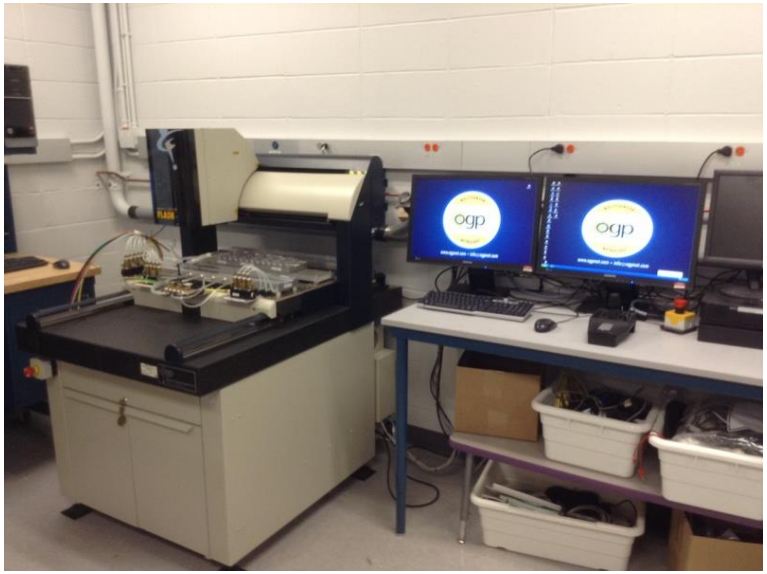
XY Stage Inspection scope





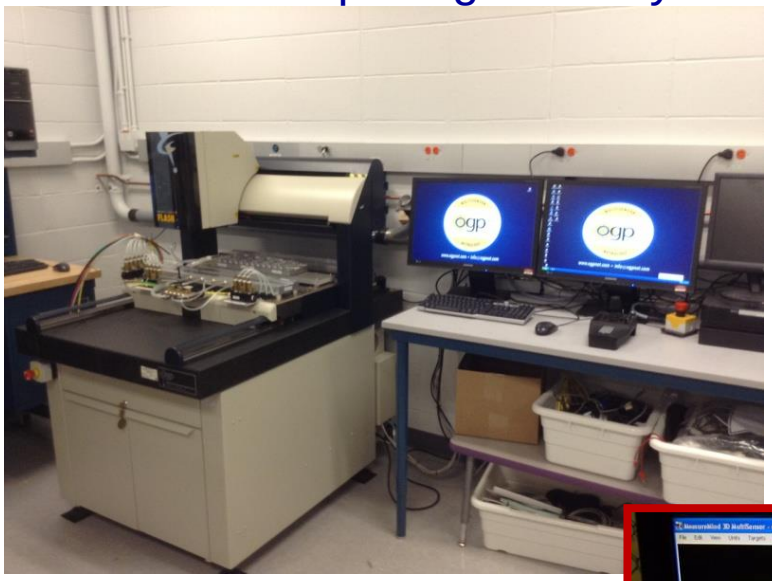
Automatic Sensor Probe Station

OGP Smart Scope alignment system



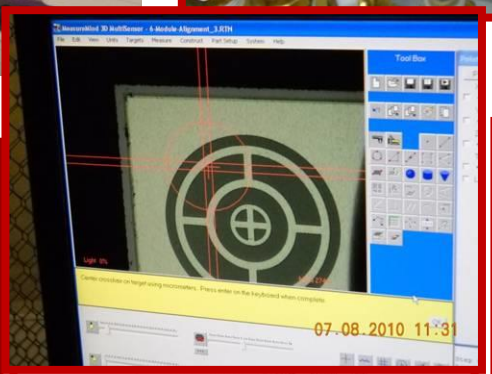
Production Capability and Assembly Facilities

OGP Smart Scope alignment system

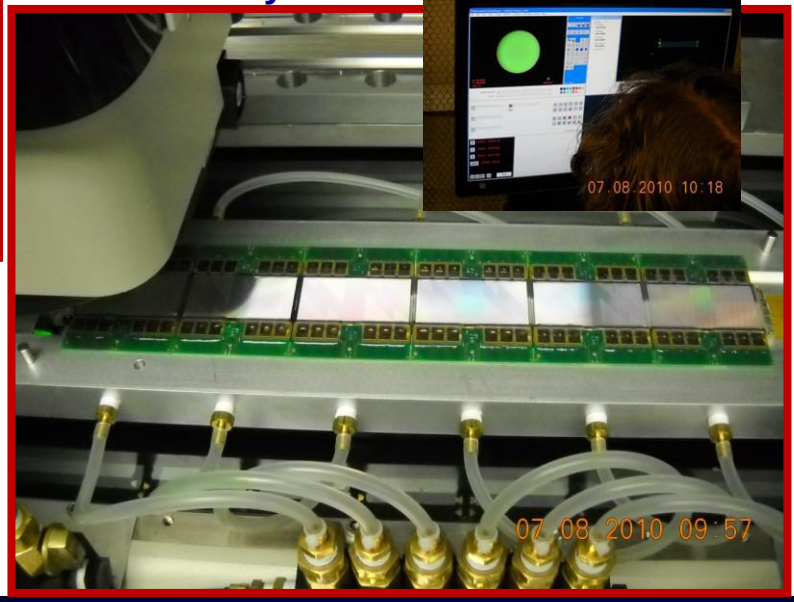


Laser scan of the stave (flatness)

Modules alignment



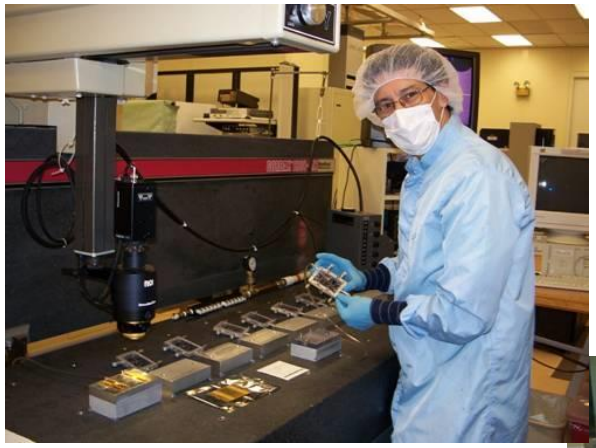
Ladder survey



Measure the reference point of the stave

Production Capability and Assembly Facilities

CMM Machine



Capability at FNAL

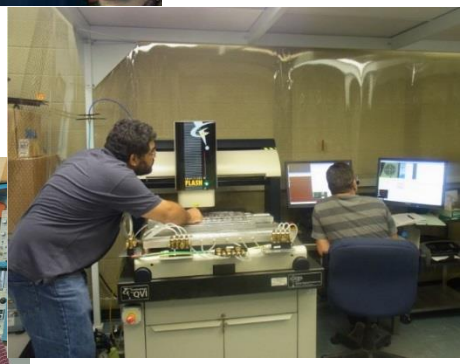
(VTX, FVTX activities at FNAL)

Wire-bonding Machine

Encapsulation Machine

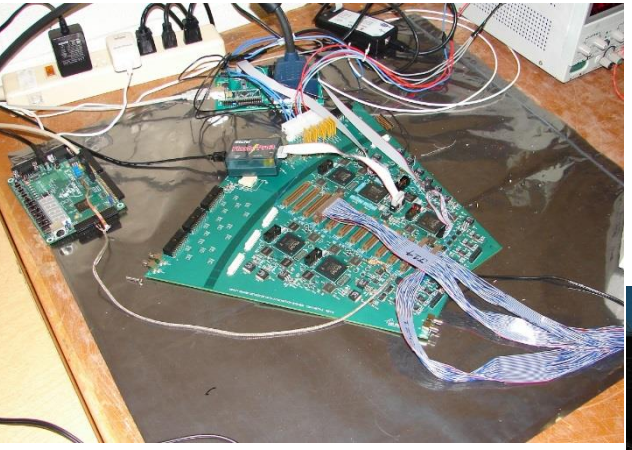
Manpower Expertise and Availability

Students + Technical Support



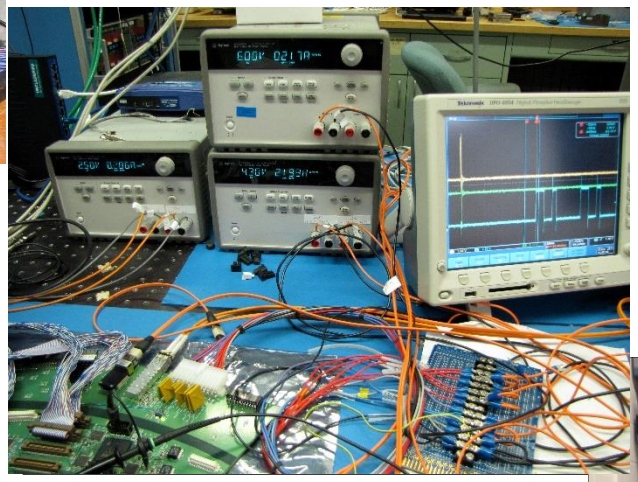
Manpower Expertise and Availability

UNM



FVTX benches' test can be used immediately to test Si Strip modules (use FPHX). They can be used to test prototype Si strip module/ladder.

LANL

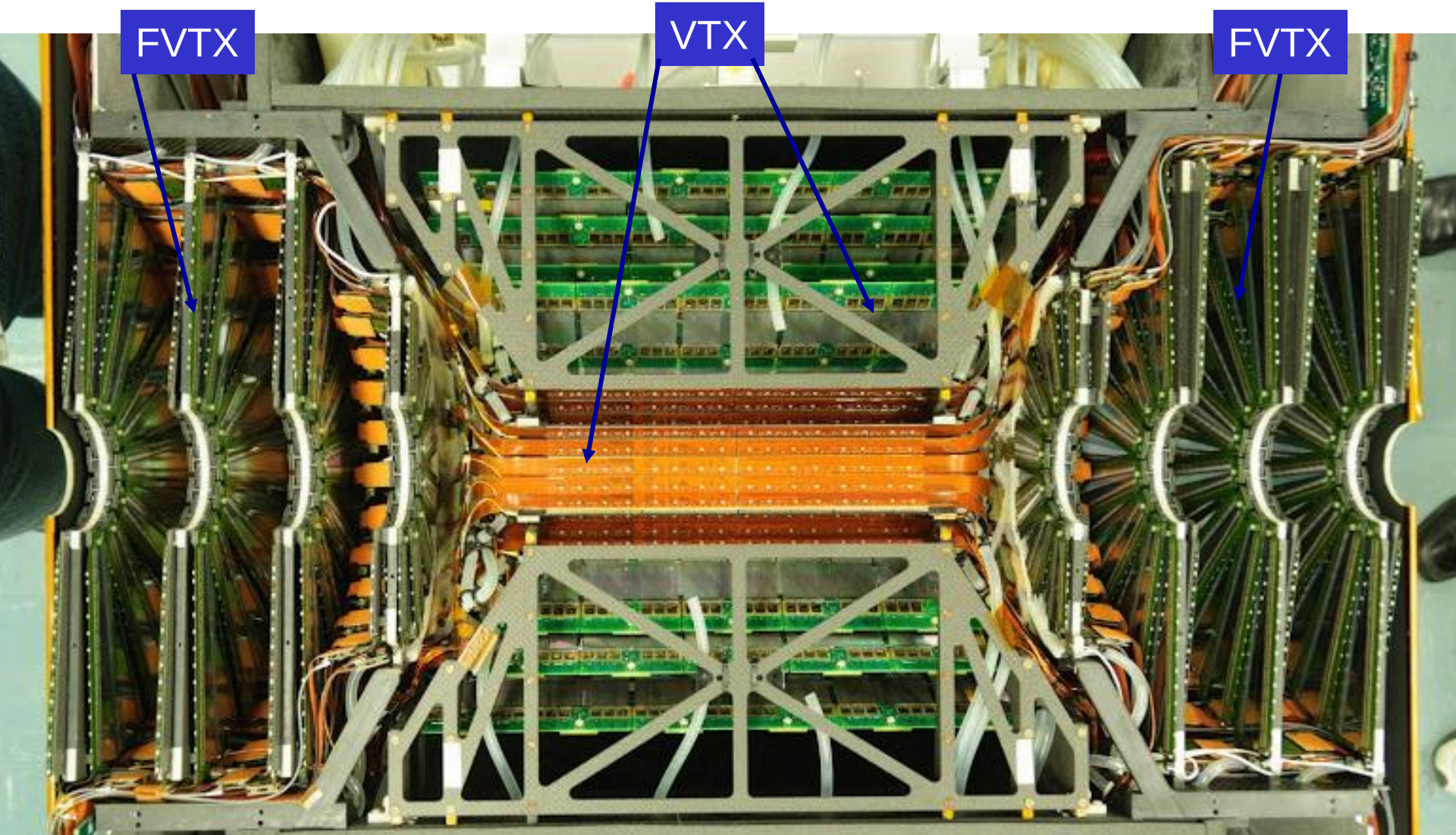


BNL

Manpower Expertise and Availability

Tremendous expertise from Si det. (VTX, FVTX) construction: BNL, LANL, RIKEN, SBU, UNM and …

→ excellent start to boost Si Strip construction successfully



Summary

- Si Strip Tracker has a conservative design. It is based on existing VTX/FVTX technology.
- We have successfully built the VTX/FVX, this means ample experience in silicon detector development and assembly.
- We have facilities, equipment, and expertise to successfully carry out the Si Tracker project.